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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/021,881	12/14/2001	Linus Albert Petter	37310-000175	2748
30595	7590	11/28/2003	EXAMINER	
HARNESS, DICKEY & PIERCE, P.L.C.			CULBERT, ROBERTS P	
P.O. BOX 8910			ART UNIT	PAPER NUMBER
RESTON, VA 20195			1763	

DATE MAILED: 11/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/021,881

Applicant(s)

FETTER ET AL.

Examiner

Roberts Culbert

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 12/14/01 . 6) ☐ Other: .

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 12, step (g), it is not clear how a top electrode is formed on the overlying material by repeating steps (a)-(e) since steps (a)-(e) specifically refer to forming the bottom electrode layer on a provided substrate. It may be surmised, for example, that the overlying layer "becomes" the substrate, that the bottom electrode "becomes" the top electrode, and that the first and second films "become" a third and fourth film similar to the stated first and second films, but this manner of stating the claim is inherently confusing as one can only guess the intended rewording and interpretation of the claim language.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1, 2, and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,464,500 to Tsujimura et al.**

Referring to Figures 7-10, Tsujimura teaches a prior art method of forming a film with a tapered edge in an electronic device, comprising: providing a substrate (11), forming a first film (13) on the substrate, forming a second film (14) on the first film, the first film having an etch rate that is different from an etch rate of the second film, forming an etching mask (15) on said second film, and etching the first

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and second films using the etching mask to form a resultant film having a tapered edge, wherein the second film is a disappearing mask layer for the first film, gradually exposing the first film to an etchant so as to produce a tapered edge which slopes to the substrate. See Figure 10.

Regarding claim 5, Tsujimura further teaches that the etch rate of said second film is faster than the etch rate of said first film. (Col. 1, Lines 33-35)

Regarding claim 7, Tsujimura teaches that the resultant film after etching is the remaining first film. (See Figure 10)

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,464,500 to Tsujimura et al. in view of U.S. Patent Application Publication 2002/0197875 to Lin et al.**

Regarding claim 4, Tsujimura teaches the method of the invention substantially as claimed, but does not teach that the second film includes Ti.

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Lin teaches that it is conventional in the art of forming tapered electrodes to form an upper metallic layer and a lower metallic layer where the etching rate of the upper metallic layer is greater than the etching rate of the lower metallic layer (Paragraph 16) and the metallic materials are selected from Cr, Al, Cu, Mo, Ta, or Ti. (Paragraph 14)

It would have been obvious to one of ordinary skill in the art at the time of invention to use Ti as the second layer instead of Mo as shown in Tsujimura, as Lin teaches that the two metals are equivalent for the purpose of forming a tapered electrode.

Regarding claim 6, Tsujimura teaches the method of the invention substantially as claimed, but does not teach that the angle of taper is controlled based on the relative etch rates of the first and second films.

Lin teaches that it is conventional in the art of forming tapered electrodes to form an upper metallic layer and a lower metallic layer where the etching rate of the upper metallic layer is greater than the etching rate of the lower metallic layer (Paragraph 16) and the angle of the etch may be controlled by selecting the metals (Paragraph 14) for the two layers and selecting the solution (Paragraph 15) for etch rate of the two layers. See also Paragraphs 3-7 and 17.

It would have been obvious to one of ordinary skill in the art at the time of invention to control the taper angle based on the relative etch rates of the first and second films as shown by Lin, as Lin teaches that the method is suitable for controlling the taper angle of an electrode using wet etching.

**Claims 3, 7, 8-10, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,464,500 to Tsujimura et al in view of U.S. Patent 5,185,589 to Krishnaswamy et al.**

Regarding claim 3, Tsujimura teaches the method of the invention substantially as claimed, but does not teach depositing at least one overlaying layer on the first film, the tapered edge ensuring that said at least one overlaying layer is continuous at a junction of the first film with the substrate.

Krishnaswamy teaches that it is conventional in the art of forming piezoelectric resonators to form a tapered aluminum electrode, deposit an overlying layer of piezoelectric material and then form another

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tapered aluminum electrode over the piezoelectric layer. (See Figures 1A and 2A, Col.1, Lines 18-22, and Col. 5, Lines 27-37) Krishnaswamy further shows that the tapered electrode edge ensures that the overlaying layer is continuous at a junction of the first film with the substrate. See Figures 1A and 2A.

It would have been obvious to one of ordinary skill in the art at the time of invention to form the tapered aluminum electrodes of Krishnaswamy using the tapered aluminum electrode forming technique of Tsujimura, the tapered electrode edge ensuring that said at least one overlaying layer is continuous at a junction of the first film with the substrate since Tsujimura teaches that the disclosed method is suitable for forming a tapered aluminum electrode using wet etching.

Regarding claim 7, Tsujimura teaches the method of the invention substantially as claimed, but does not teach that the first film is a formed bottom electrode of the electronic device.

Krishnaswamy teaches that it is conventional in the art of forming piezoelectric resonators to form a bottom tapered aluminum electrode, deposit an overlying layer of piezoelectric material and then form another top tapered aluminum electrode over the piezoelectric layer. (See Figures 1A and 2A, Col.1, Lines 18-22, and Col. 5, Lines 27-37)

It would have been obvious to one of ordinary skill in the art at the time of invention to form the bottom tapered aluminum electrode of Krishnaswamy using the tapered aluminum electrode forming technique of Tsujimura since Tsujimura teaches that the disclosed method is suitable for forming a tapered aluminum electrode using wet etching.

Regarding claim 8, Tsujimura teaches the method of the invention substantially as claimed, but does not teach that the first and second films are to be used to form a bottom electrode of the electronic device or the step of depositing a overlaying material on the formed electrode and forming a top electrode on said overlaying material by repeating the steps of providing a substrate, forming a first film on the substrate, forming a second film on the first film, the first film having an etch rate that is different from an etch rate of the second film, the first and second films to be used to form a bottom electrode of the

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electronic device, forming an etching mask on said second film, etching the first and second films using the etching mask to form the electrode with a tapered edge.

Krishnaswamy teaches that it is conventional in the art of forming piezoelectric resonators to form a tapered aluminum electrode, deposit an overlying layer of piezoelectric material and then form another tapered aluminum electrode over the piezoelectric layer. (See Figures 1A and 2A, Col.1, Lines 18-22, and Col. 5, Lines 27-37)

It would have been obvious to one of ordinary skill in the art at the time of invention to form the tapered aluminum electrodes of Krishnaswamy using the tapered aluminum electrode forming technique of Tsujimura since Tsujimura teaches that the disclosed method is suitable for forming a tapered aluminum electrode using wet etching. The benefits of wet etching techniques are well known in the etching art to include advantages such as low cost, reliability, high throughput and selectivity to mask and substrate.

**Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,464,500 to Tsujimura et al in view of U.S. Patent 5,185,589 to Krishnaswamy et al. and in further view of U.S. Patent Application Publication 2002/0197875 to Lin et al.**

Regarding claim 11, Tsujimura in view of Krishnaswamy teaches the method of the invention substantially as claimed, but does not teach that the second film includes Ti.

Lin teaches that it is conventional in the art of forming tapered electrodes to form an upper metallic layer and a lower metallic layer where the etching rate of the upper metallic layer is greater than the etching rate of the lower metallic layer (Paragraph 16) and the metallic materials are selected from Cr, Al, Cu, Mo, Ta, or Ti. (Paragraph 14)

It would have been obvious to one of ordinary skill in the art at the time of invention to use Ti as the second layer instead of Mo as shown in Tsujimura, as Lin teaches that the two metals are equivalent for the purpose of forming a tapered electrode.

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Regarding claim 13, Tsujimura in view of Krishnaswamy teaches the method of the invention substantially as claimed, but does not teach that the angle of taper is controlled based on the relative etch rates of the first and second films.

Lin teaches that it is conventional in the art of forming tapered electrodes to form an upper metallic layer and a lower metallic layer where the etching rate of the upper metallic layer is greater than the etching rate of the lower metallic layer (Paragraph 16) and the angle of the etch may be controlled by selecting the metals (Paragraph 14) for the two layers and selecting the solution (Paragraph 15) for etch rate of the two layers. See also Paragraphs 3-7 and 17.

It would have been obvious to one of ordinary skill in the art at the time of invention to control the taper angle based on the relative etch rates of the first and second films as shown by Lin, as Lin teaches that the method is suitable for controlling the taper angle of an electrode using wet etching.

#### **Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (703) 305-7965. The examiner can normally be reached on Monday-Friday (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703) 308-1633. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

R. Culbert

